

# PATENT COOPERATION TREATY

## PCT

### INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference <b>P6510PC00</b>	<div style="display: flex; justify-content: space-between;"> <span><b>FOR FURTHER ACTION</b></span> <span>See Form PCT/IPEA/416</span> </div>	
International application No. <b>PCT/AU2004/001061</b>	International filing date (day/month/year) <b>10 August 2004</b>	Priority date (day/month/year) <b>11 August 2003</b>
International Patent Classification (IPC) or national classification and IPC  <b>Int. Cl. <sup>7</sup> E02D 35/00</b>		
Applicant  <b>ONG, Chin,Chai</b>		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

3. This report is also accompanied by ANNEXES, comprising:

a. ☒ (sent to the applicant and to the International Bureau) a total of ~~10~~<sup>9</sup> sheets, as follows:

☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

b. ☐ (sent to the International Bureau only) a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or table related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I      Basis of the report

☐ Box No. II      Priority

☐ Box No. III      Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

☐ Box No. IV      Lack of unity of invention

☒ Box No. V      Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

☐ Box No. VI      Certain documents cited

☐ Box No. VII      Certain defects in the international application

☐ Box No. VIII      Certain observations on the international application

Date of submission of the demand <b>4 March 2005</b>	Date of completion of the report <b>17 June 2005</b>
Name and mailing address of the IPEA/AU <b>AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929</b>	Authorized Officer  <b>E.J. MARTYN</b> Telephone No. (02) 6283 2332

## Box No. I Basis of the report

1. With regard to the language, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1 (b))
- ☐ publication of the international application (under Rule 12.4)
- ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the elements of the international application, this report is based on (*replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report*):
- ☐ the international application as originally filed/furnished
- ☒ the description:
- pages 1 - 5, 8 - 14 as originally filed/furnished
- pages\* 6, 7 received by this Authority on 10 June 2005 with the letter of 10 June 2005
- pages\* received by this Authority on with the letter of
- ☒ the claims:
- pages as originally filed/furnished
- pages\* as amended (together with any statement) under Article 19
- pages\* 15 - 21 received by this Authority on 10 June 2005 with the letter of 10 June 2005
- pages\* received by this Authority on with the letter of
- ☒ the drawings:
- pages 1 - 7 as originally filed/furnished
- pages\* received by this Authority on with the letter of
- pages\* received by this Authority on with the letter of
- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
- ☐ the claims, Nos.
- ☐ the drawings, sheets/figs
- ☐ the sequence listing (*specify*):
- ☐ any table(s) related to the sequence listing (*specify*):

\* If item 4 applies, some or all of those sheets may be marked "superseded."

**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims 1 - 19	YES
	Claims	NO
Inventive step (IS)	Claims 1 - 19	YES
	Claims	NO
Industrial applicability (IA)	Claims 1 - 19	YES
	Claims	NO

**2. Citations and explanations (Rule 70.7)****Claims 1 - 19**

The invention of the amended claims is an underpinning pile system comprising a pile transfer beam, a pile anchor head to engage with the head of the pile and a jacking means. The transfer beam includes an opening to receive the pile anchor head, which in turn receives the pile. The transfer beam is arranged to engage under the foundations at points on either side of the opening. The jacking means engages between the transfer beam and the pile to drive the pile downwardly through the transfer beam through the pile anchor head.

No individual citation or obvious combination of citations discloses the present invention.

**The closest art:**

CA 2235890 A

US 5433556 A

US 6193442 B

US 2001/0046415 A

Therefore the subject matter of these claims is new and not obvious and meets the requirements of Article 33(2) and 33(3) PCT with regard to novelty and inventive step.

A significant aspect of the present invention is that the pile anchor head is adapted to receive the building load and transfer it to practically any kind of material and shape of pile without restricting to the common use of steel pipes in underpinning.

According to one aspect of the present invention there is provided an underpinning pile system for lifting and underpinning a settling foundation comprising:

- 10 a pile;
- a transfer beam having an opening for receiving the upper end of the pile, the transfer beam being arranged to engage with the foundation on at least two points, one either side of said opening;
- 15 a pile anchor head receivable in the opening in the transfer beam, the pile anchor head having a hollow section for receiving the upper end of the pile and a portion arranged to engage with the transfer beam adjacent the opening; and
- a jacking means engageable with the transfer beam and the
- 20 upper end of the pile;
- wherein the jacking means exerts a force on the upper end of the pile to drive the pile downwardly relative to the stationary transfer beam.

- 25 In another aspect of the present invention, there is provided a method for installing an underpinning pile system for lifting and underpinning a settling foundation characterised by comprising the steps of:
- excavating a hole adjacent to the foundation;
- 30 placing a transfer beam having an opening for receiving the upper end of a pile in the excavated hole, the transfer beam being arranged to engage with the foundation on at least two points, one either side of said opening;

placing a pile anchor head having a hollow section for receiving the upper end of the pile in the opening in the transfer beam such that the pile anchor head engages with the transfer beam adjacent the opening;

5 placing a pile through the hollow section in the pile anchor head;

engaging a jacking means with the transfer beam and the upper end of the pile; and

driving the pile downwardly relative to the stationary

10 transfer beam by operation of the jacking means.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Further understanding of the aspects of the present invention and their advantages will be discerned after

15 studying the Detailed Description in conjunction with the accompanying drawings in which:-

Fig 1 shows an underpinning pile according to one embodiment of the present invention;

Fig 2 shows an underpinning piling system and the auxiliary

20 apparatus;

Fig 3a shows a typical pile anchor head with optional attachments of triangular wedges and with nuts and bolts at corresponding positions to match a transfer beam;

Fig 3b shows another variation of a typical pile anchor head

25 with a wider out splayed flange and web;

Fig 4 shows installing two C-channels sides by side on each side of the pile anchor head;

Fig 5 shows the placing of a thrust block into the space between the gap of the parallel C-channels and inserting two

30 large pins into the receiving holes at the ends of the thrust block just clearing beneath the soffit of the parallel C-channels;

Fig 6 shows the placing of a hydraulic jack over the top of the underpinning pile;

CLAIMS

1. An underpinning pile system for lifting and underpinning a settling foundation characterised by  
5 comprising:

a pile;

a transfer beam having an opening for receiving the upper end of the pile, the transfer beam being arranged to engage with the foundation on at least two points, one

10 either side of said opening;

a pile anchor head receivable in the opening in the transfer beam, the pile anchor head having a hollow section for receiving the upper end of the pile and a portion arranged to engage with the transfer beam

15 adjacent the opening; and

a jacking means engageable with the transfer beam and the upper end of the pile;

wherein the jacking means exerts a force on the upper end of the pile to drive the pile downwardly relative to the  
20 stationary transfer beam.

2. An underpinning pile system in accordance with claim 1, characterised in that the pile anchor head includes a locking means for securing movement of the pile relative to the pile anchor head once the pile is driven into  
25 position under a jacking load.

3. An underpinning pile in accordance with claim 2, characterised in that the locking means comprises an anchor plate securable across the hollow section to bear on top of the pile.

5 4. An underpinning pile in accordance with claim 3 characterised in that the pile anchor head comprises a hollow member having a tabular cross section complementary to the cross sectional shape of the pile.

10 5. An underpinning pile in accordance with claim 3, characterised in that the cross section of the hollow member is complementary to the shape of the anchor plate such that the anchor plate is secured within the hollow member against the upper end of the pile by welding to inner surfaces of the hollow member.

15 6. An underpinning pile in accordance with any one of the preceding claims, characterised in that the portion of the pile anchor head that engages with the transfer beam comprises a plurality of flanges that engage with an underside of the transfer beam.

20 7. An underpinning pile in accordance with any one of the preceding claims characterised in that the transfer beam comprises two members secured parallel to and separated from each other to define the opening.

8. An underpinning pile in accordance with claim 7, characterised in that the members each comprise a C-channel members arranged with open sides thereof oriented in opposite directions.

5 9. An underpinning pile in accordance with any one of the preceding claims, characterised in that the jacking means comprises an inverted U-shaped thrust block and a jack, the inverted U-shaped thrust block arranged such that ends of parallel legs of the thrust block extend  
10 downwardly through the opening in the transfer beam on either side of the pile and engage with the transfer beam, and the jack engages between the upper horizontal member of the inverted U-shaped thrust block and the upper end of the pile to force the pile downwardly  
15 relative to the thrust block.

10. An underpinning pile in accordance with claim 9, characterised in that the ends of the legs of the inverted U-shaped thrust block are provided with holes to receive locking pins such that when the holes are  
20 positioned below the transfer beam and the locking pins are inserted through the holes, the locking pins engage with the lower surface of the transfer beam to resist upward movement of the U-shaped thrust block relative to the transfer beam.



11. An underpinning pile in accordance with claim 10,  
characterised in that the legs of the U-shaped thrust  
block include outwardly extending wedges, the wedges  
engaging with an upper surface of the transfer beam when  
5 the U-shaped thrust block is inserted downwardly through  
the opening in the transfer beam.

12. A method for installing an underpinning pile system  
for lifting and underpinning a settling foundation  
characterised by comprising the steps of:

- 10 excavating a hole adjacent to the foundation;  
placing a transfer beam having an opening for receiving  
the upper end of a pile in the excavated hole, the  
transfer beam being arranged to engage with the  
foundation on at least two points, one either side of  
15 said opening;  
placing a pile anchor head having a hollow section for  
receiving the upper end of the pile in the opening in the  
transfer beam such that the pile anchor head engages with  
the transfer beam adjacent the opening;  
20 placing a pile through the hollow section in the pile  
anchor head;  
engaging a jacking means with the transfer beam and the  
upper end of the pile; and  
driving the pile downwardly relative to the stationary  
25 transfer beam by operation of the jacking means.

13. A method for installing an underpinning pile system in accordance with claim 12, characterised by including the step of securing any further movement of the pile relative to the pile anchor head once the pile is driven  
5 into position and loaded with a locking means to engage the pile with the pile anchor head.

14. A method for installing an underpinning pile system in accordance with claim 13, characterised by including the steps of driving the pile downwardly until the upper  
10 end of the pile is within the hollow section of the pile anchor head and inserting an anchor plate into the hollow section to bear on the top of the pile and welding the anchor plate to internal surfaces of the hollow section of the pile anchor head.

15 15. A method for installing an underpinning pile system in accordance with any one of claims 12 to 14, characterised in that engaging the jacking means with the transfer beam and the pile comprises the steps of:

inserting legs of an inverted U-shaped thrust block  
20 downwardly through the opening in the transfer beam such that the legs are positioned on opposite sides of the pile;

engaging ends of the legs with the transfer beam; and

inserting a jack between the upper end of the pile and a lower side of a horizontal member of the inverted U-shaped thrust block.

16 A method for installing an underpinning pile system in  
5 accordance with claim 15, characterised in that locking pins are inserted through holes provided in the ends of the legs of the inverted U-shaped thrust block when the ends of the legs are located below the transfer beam, such that the locking pins engage with a lower surface of  
10 the transfer beam and thereby resist upward movement of the inverted U-shaped thrust block relative to the transfer beam.

17. A method for installing an underpinning pile system in accordance with claim 16 characterised in that the  
15 step of driving the pile downwardly relative to the transfer beam comprises the step of extending the jack to force the pile downwardly relative to the thrust block.

18. A method for installing an underpinning pile system in accordance with any one of the preceding claims including  
20 the step of securing the pile anchor head to the transfer beam once the pile is driven into position and secured to the pile anchor head.

19. A method for installing an underpinning pile system in accordance with claim 19 characterised by placing a  
25 plurality of wedges such that the wedges engage against

the pile anchor head and the transfer beam, and welding  
the wedges to the transfer beam and the pile anchor head.